light loads the rate may fall to 300 or 400, and at heavy overloads increase somewhat beyond the values for normal load. The main reasons for these variations is that the air leakage usually increases somewhat as the load decreases, that is, the ratio of air to steam entering the condenser increases rapidly as the engine or turbine load decreases, and at light loads the lower tubes are more or less surrounded by a mixture of relatively stagnant air and vapour.

Condenser Calculations.—The calculation of the weight of circulating water is similar to that given on p. 221, relating to jet condensers, except that the circulating water and the water of condensation leave at different temperatures. Taking the conditions as follow: exhaust steam temperature, 105° F.; circulating water inlet, 76° F.; and outlet, 95° F.; water of condensation leaving at 100° F.; then, with the value of L = 946 B.Th.U. per pound,

$$^{W}(9S - 7^{6}) = \hat{}(94^{6} + {}^{IG}5 - 100),$$

$$\text{or } \frac{W}{w} = \& \frac{951}{19}$$

= 50 Ib. per pound of steam condensed.

With regard to the total length of tube required between the inlet and outlet of the circulating water for given conditions of operation, the following method of calculation can be used:

Let T_s = steam inlet temperature, degrees Fahrenheit.
*! = inlet water temperature, degrees Fahrenheit.
j?$_2$ = outlet water temperature, degrees Fahrenheit.
K = rate of heat transmission, B.Th.U. per square foot per hour per degree Fahrenheit difference.
p = density of water, pounds per cubic foot.
v = velocity of water through tubes, feet per second (assumed uniform).
dfj = outside diameter of tube, inches (steam side).
J$_2$ = inside diameter of tube, inches (water side).
n = number of tubes per pass (assumed the same for each pass).
/ = length of tube per pass, feet.
or = number of passes.
S = total outside tube surface, square feet.
W = circulating water, pounds per hour.

It is generally taken that the mean difference of temperature t_m between the steam and the water is given by